

Standardized Measures for Managing and Reducing Behavioral Health and Performance Risks

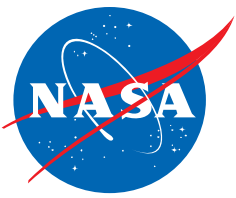
Investigators Workshop

January 23-25, 2017

Thomas J. Williams, PhD

Element Scientist

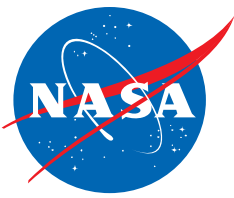
Human Factors and Behavioral Performance



Agenda

- Trends toward Standard Measures?
- HRP's Vision
- Standard Measures-Baseline
- Behavioral Core Measures
- BHP-Standard Measures: HERA
- Research vs Standard Measures

Standard Measures in health care



Patients in Context — EHR Capture of Social and Behavioral Determinants of Health

Nancy E. Adler, Ph.D., and William W. Stead, M.D.

Although social and behavioral factors influence health and mortality, such determinants of health, delineated by an Institute of Medicine (IOM) committee that we cochaired, will A growing body of research links social and behavioral factors including low income, low

“The use of standard measures offers the opportunity to efficiently identify conditions that may modify diagnoses and treatment plans and renders the information usable by various systems for various purposes.”

Patients in context—EHR Capture of social and behavioral determinants of health, Adler NE, Stead WW, N Engl J Med, 2015 Feb 19

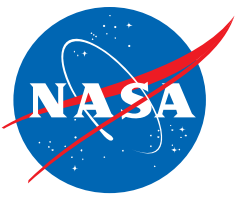
Social and Behavioral Domains and Measures.

Domain	Measure ^a	Frequency
Race or ethnic group†	1. What is your race? 2. Are you of Hispanic, Latino, or Spanish origin?	At entry
Education	1. What is the highest level of school you have completed? 2. What is the highest degree you earned?	At entry
Financial-resource strain	How hard is it for you to pay for the very basics like food, housing, medical care, and heat?	Screen and follow up
Stress	Stress means a situation in which a person feels tense, restless, nervous, or anxious, or is unable to sleep at night because his or her mind is troubled all the time. Do you feel this kind of stress these days?	Screen and follow up
Depression	Over the past 2 weeks, how often have you been bothered by 1. Little interest or pleasure in doing things? 2. Feeling down, depressed, or hopeless?	Screen and follow up
Physical activity	1. On average, how many days per week do you engage in moderate to strenuous exercise (like walking fast, running, jogging, dancing, swimming, biking, or other activities that cause a light or heavy sweat)? 2. On average, how many minutes do you engage in exercise at this level?	Screen and follow up
Tobacco use†	1. Have you smoked at least 100 cigarettes in your entire life? If yes: 2. Do you now smoke cigarettes every day, some days, or not at all?	Screen and follow up
Alcohol use†	1. How often do you have a drink containing alcohol? 2. How many standard drinks containing alcohol do you have on a typical day? 3. How often do you have six or more drinks on one occasion?	Screen and follow up
Social connection or isolation	1. In a typical week, how many times do you talk on the telephone with family, friends, or neighbors? 2. How often do you get together with friends or relatives? 3. How often do you attend church or religious services? 4. How often do you attend meetings of the clubs or organizations you belong to?	Screen and follow up
Intimate-partner violence	1. Within the last year, have you been humiliated or emotionally abused in other ways by your partner or ex-partner? 2. Within the last year, have you been afraid of your partner or ex-partner? 3. Within the last year, have you been raped or forced to have any kind of sexual activity by your partner or ex-partner? 4. Within the last year, have you been kicked, hit, slapped, or otherwise physically hurt by your partner or ex-partner?	Screen and follow up
Residential address†	What is your current address?	Verify at every visit
Census-tract median income	Geocoded	Update on address change

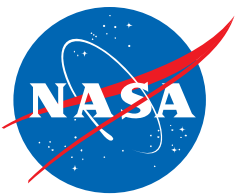
^a Wording is taken from existing measures; standard response categories are available. Psychometric testing of the full panel, including ordering and wording, has not yet been conducted.

† This domain is already widely included in clinical practice.

Benefits of Standard Measures

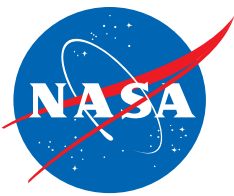


- Accurately characterizes risk factors and outcomes
- Provides researchers the opportunity to evaluate cross-discipline relationships among multiple systems involved in adapting to, living in, and returning from space
- Systematically assess changes over time within and across missions in spaceflight and spaceflight analogs



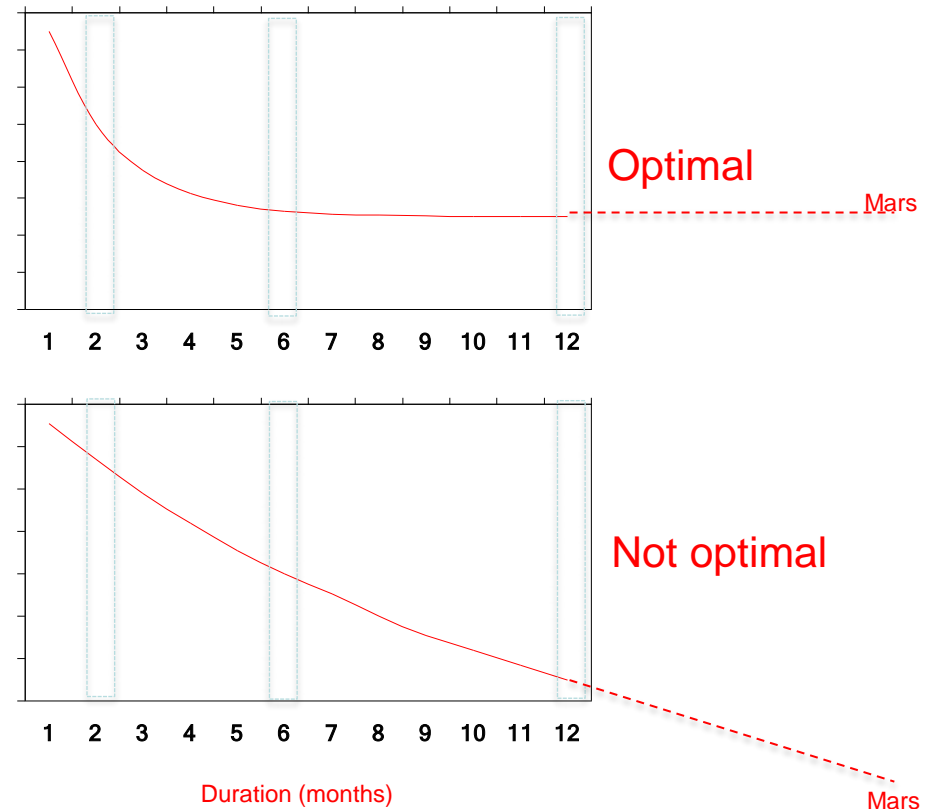
Why Behavioral Health and Performance Standard Measures?

- Facilitate integrated assessment & understanding
- Identify & characterize risk across settings & missions
- Expand capacity: more sensitive/specific identification of “space normal”
 - Better define countermeasures
 - Tailor (personalized)
 - Precision medicine
- Psychosocial “vital signs”

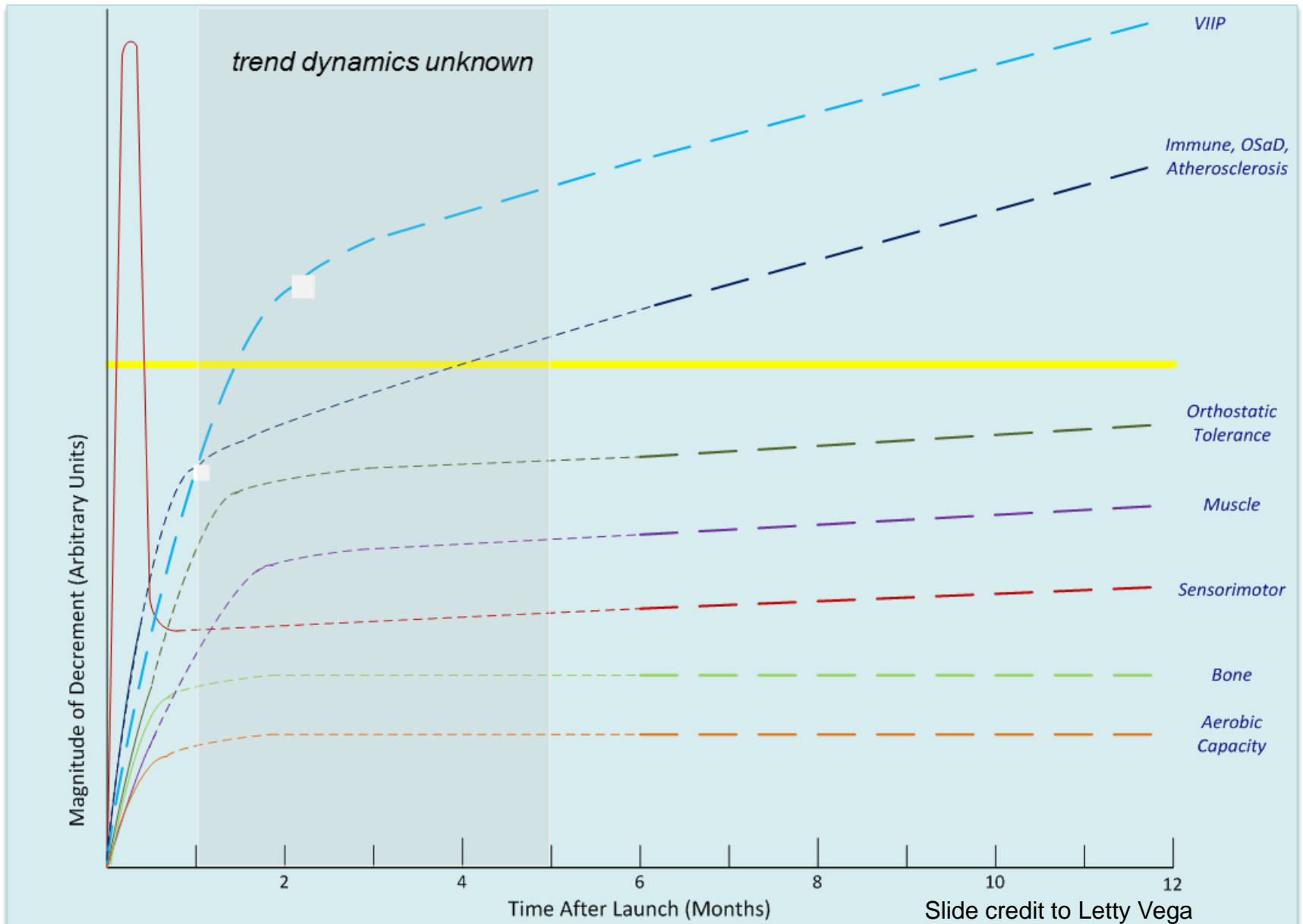
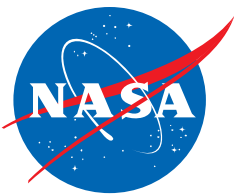


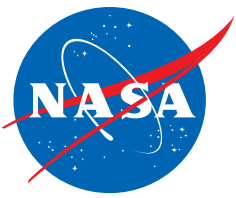
Future 1YM Program

- HRP is proposing a coordinated program of 1YM, taxi flights, and 6-month missions
 - Same measures at 3 discrete durations
 - Larger n, increases confidence in 1YM data
 - May observe early changes in adaptation not noticed previously



Mission Unknowns





Considerations for Selection of Standard Measures - HRP

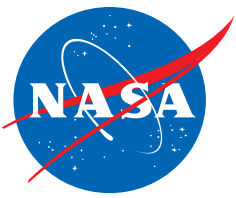
- Assess every Human Health and Performance Risk in HRP
- Should be based on validated/established measures
- Primarily outcome measures tied to health and performance
- Establish a baseline for testing of future in-flight countermeasures
- Enable comparison of one-year and six-month missions
- Provide standard measurements for investigators to use in proposed projects
- Provide database (LSDA) for data-mining and integrative modeling
- A Standard Measure in a discipline area does not mean that future projects cannot propose new measures for specific investigations in that area



Standard Measures-Baseline

				FD30 +/- 15d			FD150 +/-30d						FD330 +/-30d		
Mission		Pre	FM1	FM2	FM3	FM4	FM5 or FM6	FM7	FM8	FM9	FM10	FM11 or FM12	Post	Risk	
60 Day	Cognitive testing and VAS		*											BMED	
	Team functioning													TEAM	
	Biochemical markers (blood only)													VIIP, Food Medical	
	Sleep quality (actigraphy & PMC questions)													Sleep	
	Cellular profile - Immune (ambient blood, saliva)													Immune	
	Swabs of skin and nasal mucosa, saliva, and fecal samples													Microhost and Immune	
	Sit to stand test/tandem walk, recovery from fall, motion sickness eval cIMT													Sensorimotor Alterations VIIP, Degen, Immune	
180 Day	Cognitive testing and VAS													BMED	
	Team functioning													TEAM	
	Biochemical markers (blood only)													VIIP, Food Medical	
	Sleep quality (Actigraphy & PMC questions)				*	*								Sleep	
	Cellular profile - Immune (ambient blood, saliva)													Immune	
	Swabs of skin and nasal mucosa, saliva, and fecal samples													Microhost and Immune	
	Sit to stand test/tandem walk, recovery from fall, motion sickness eval cIMT													Sensorimotor Alterations VIIP, Degen, Immune	
365 Day	Cognitive testing and VAS													BMED	
	Team functioning													TEAM	
	Biochemical markers (blood only)													VIIP, Food Medical	
	Sleep quality (Actigraphy & PMC questions)							*	*	*	*			Sleep	
	Cellular profile - Immune (ambient blood, saliva)													Immune	
	Swabs of skin and nasal mucosa, saliva, and fecal samples													Microhost and Immune	
	Sit to stand test/tandem walk, recovery from fall, motion sickness eval cIMT													Sensorimotor Alterations VIIP, Degen, Immune	
Med Bs and Env	Comprehensive ocular/visual testing (MedB 1.10)													VIIP	
	Nutritional assessment (MedB N3.06)													Food, Bone Fracture	
	DXA													Bone Fracture	
	Physical Exam (MedB 1.1; full exam and two brief)													Overall characterization of health of crewmember	
	Blood and urine data (MedB 2.1)		(as clinically indicated)												
	Periodic Health Status exams (MedB 1.2) and PMCs (MedB 1.3)														
	In-flight medication logs													PK/PD	
	VO2 max (MedB 4.1)						1YM only							Aerobic Capacity	
	Event reporting - EMU injuries via PHSs (1.2) and PMCs (1.3)													Medical	
	Event reporting - DCS reports via PMCs (MedB 1.3)													DCS and Medical	
	Functional fitness assesments													Muscle	
	Computerized Dynamic Posturography													Sensorimotor Alterations	
	Crew Debriefs (Food, HAB, HARI, TRAIN, TASK, etc)													HSID	
	ISS Environmental data: air, surface, H2O microbial monitoring													Overall characterization of the environment and crew exposures during mission	
	MR0093, MR005L, MR004L, MedB 3.1 - Radiation monitoring														
	Air and water quality (real-time and archival samples)														

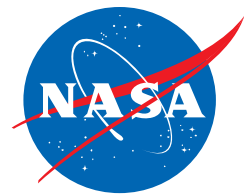
Behavioral Health and Performance Standard Measures & Habitability



- Psychological Factors relevant to success of mission
 - **Individual** (adaptation and performance)
 - Personality
 - Motivation
 - Visual/Perceptual Processing
 - **Group** (small groups in confined quarters)
 - Psychosocial factors
 - Reduce interpersonal conflict/conflict resolution
 - Decrease risk of psychological problems
 - **Environmental**
 - Social organizational
 - Meaningfulness/division of labor
 - Intellectual challenge/Avoiding boredom
 - Design (harmonious group living)
 - Privacy
 - Habitability (sleep areas
 - Social (interpersonal connectedness in flight, back to earth)

Behavioral Health and Performance

Purpose & Risks



Purpose

Manage and mitigate the behavioral health and performance risks associated with space travel, exploration and return to terrestrial life



Risk of Adverse Cognitive & Behavioral Conditions and Psychiatric Disorders



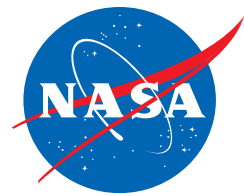
Risk of Performance and Behavioral Health Decrements due to Inadequate Cooperation, Coordination, Communication and Psychosocial Adaptation within a Team



Risk of Performance Decrements and Adverse Health Outcomes Resulting from Sleep Loss, Circadian De-synchronization, and Work Overload



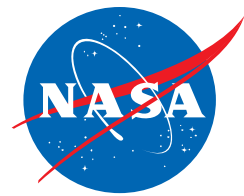
Behavioral Health and Performance Standard Measures



Why - To establish a common set of measures for use in spaceflight and analog research to: develop baselines, systematically characterize risk likelihood and consequences, and assess countermeasure effectiveness



Behavioral Health and Performance Standard Measures



Behavioral Core Measures NRA

Implement validated measures to assess cognition, operational performance, well being, team cohesion, sleep and circadian phase



- **Cognition** (Vigilant attention, psychomotor speed, lapses of attention, impulsivity, etc.)
- **Neurobehavioral signs of stress & fatigue** (mental & physical) using Visual Analog Scales (VAS)
- **Personality** ("Big Five Factors")
- **Journals**
- **Team cohesion vs conflict**
- **Actigraphy** (activity/wake cycles)
- **ROBoT** (operational performance task)



Cognition Test Battery



Lexical Indicators



ROBoT

HRP Standard Measures

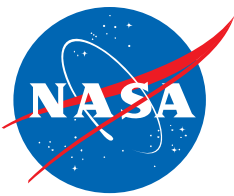
- Covers all HRP risks
- Allows comparison of 6 & 12 month ISS missions
- Cognition
- Neurobehavioral assessments using VAS
- Team cohesion vs conflict
- Actigraphy
- ROBoT
- Additional measures as appropriate (e.g., personality factors related to spaceflight adaptability)



Sleep-Wake Actigraphy



Sociometric Badges



BHP Standard Measures

HERA Pre-Mission

(Pre-Mission) Cognition Familiarization 4X

- Pre-battery questions
 - Mental exhaustion
 - Fatigue
 - Stress
 - Workload
 - Sleep Quality

Performance

- ROBoT 3X

Questionnaires

- Psychological Screening
 - BDI-II (depression)
 - SDS-17 (social desir)
 - POMS_SF 3X
- Team
 - Team Measures 1X
 - Big Five NEO-120
 - Demographics

BMed

Cognition Battery 19X

- Pre-battery questions
 - Mental exhaustion
 - Fatigue
 - Stress
 - Workload
 - Sleep Quality

Questionnaires (VAS)

- Pre-Sleep
- Post-Sleep (daily)
- Other
- Subjective
- Psychological Screening
- BDI Depression Screen

6X

- POMS-SF (daily)
- Heart rate/variability (daily)

Team

Team Measures

- Group Living (3X)
- Sociometric Badges
- Pre-sleep (daily) (Crew/MCC)
- Cohesion
- Conflict
- Performance
- Team Weekly (6X)
- Team Climate
- Team Process
- Social Support (4X)

Sleep & Fatigue

Actigraphy monitoring Sleep/Wake activity -Actigraph (daily)

Performance

- ROBoT 19X
- Cognition (PVT)

HERA Post-Mission

Post-Mission Debrief

Cognition Battery 3X

- Pre-battery questions
 - Mental exhaustion
 - Fatigue
 - Stress
 - Workload
 - Sleep Quality

Questionnaires

-Psychological Screening

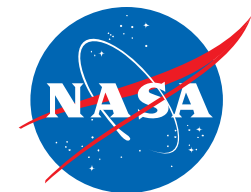
- BDI Depression Screen
- POMS-SF 3X

Performance

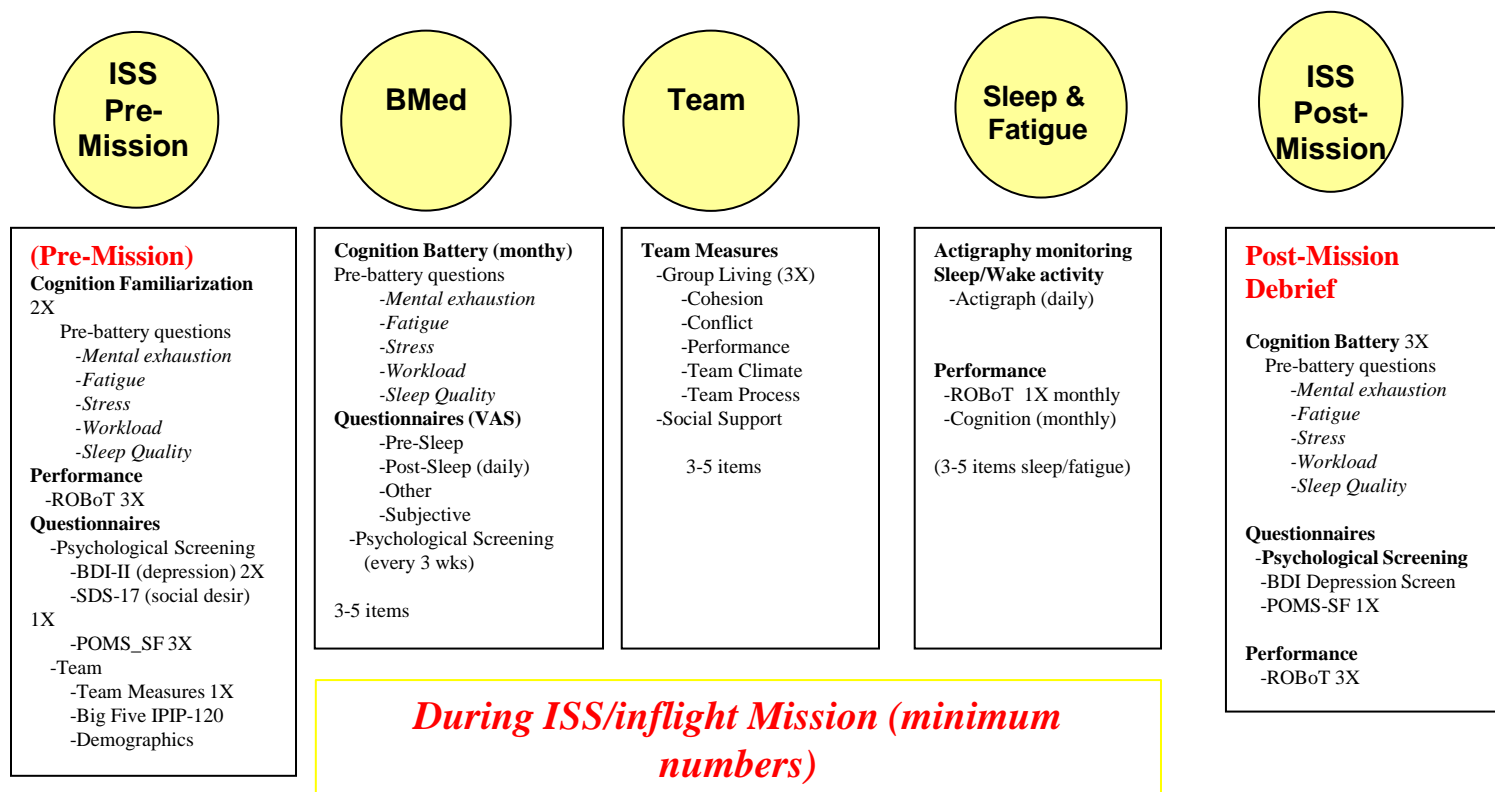
- ROBoT

During HERA Mission

Modeled after Dinges et al, Behavioral Core Measures

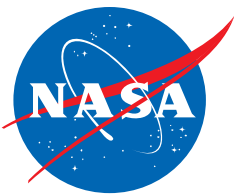


HRP Standard Measures (Not final)

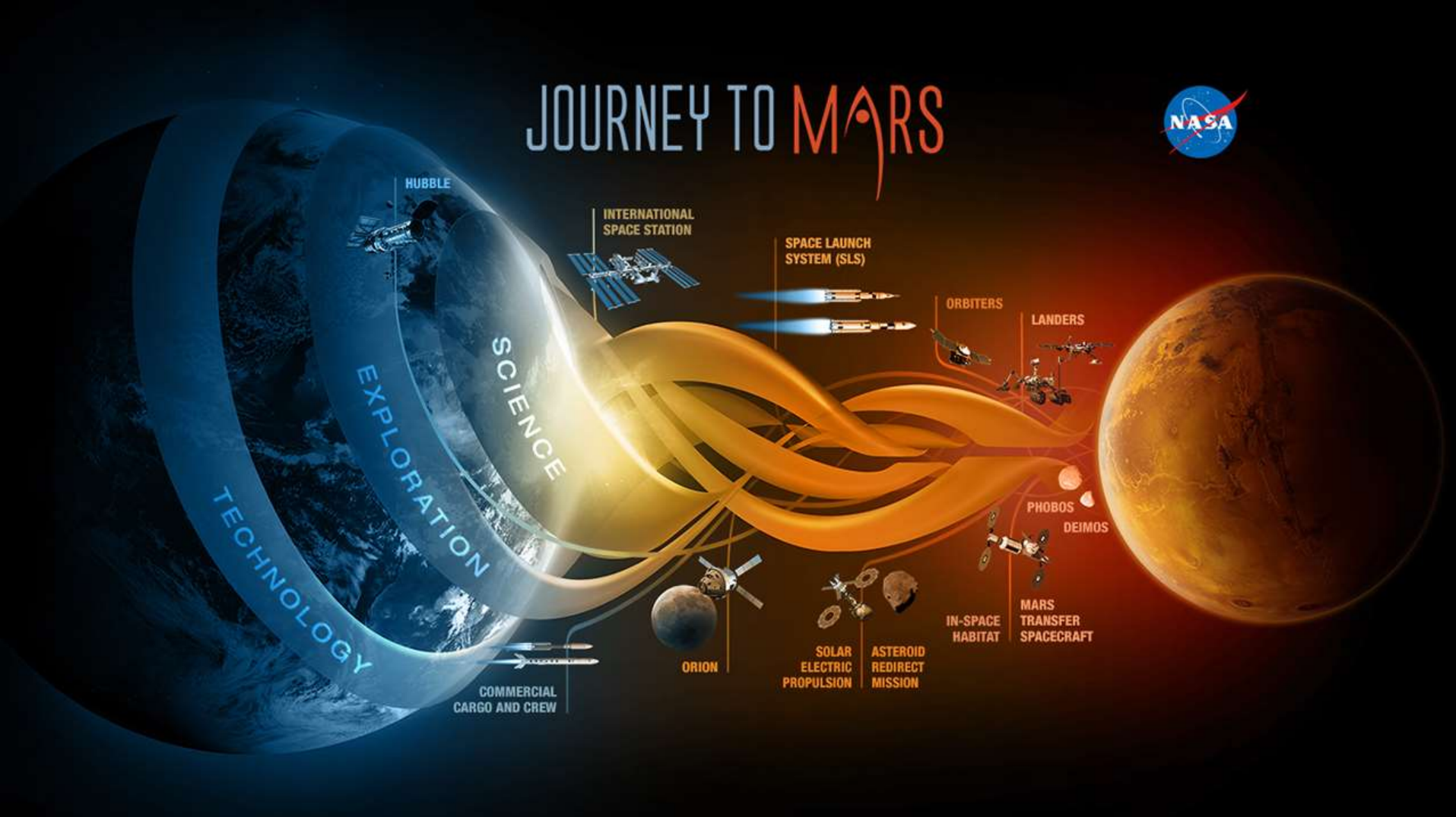


DRAFT (these will be revised based on results of Dinges et al
BCM research results, o/a May 2017)

Challenges of Standard Measures



- Cultural change (“frames of thinking”)
 - Social & behavioral determinants
- “Standard” exists...
 - Available
 - Useful (valid & reliable)
 - Feasible & acceptable (to measure & to know)
 - Not available from other sources (unobtrusive measures)
- Privacy vs operational mission
 - Not overly sensitive to ask
 - Operational relevance vs research “interests”
- Added demands: elusive “Gold standard”
- Sensitivity/specificity of data (continuum)
 - Lab result vs psychological “result”
 - Monitoring vs intervention



QUESTIONS?